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## REMARKS

### Rejection of Claims 1 and 2 under Mueller *et al.* under §102(e)

In the Office Action, Claims 1 and 2 stand rejected under 35 U.S.C. §102(e) as being anticipated by Mueller *et al.* Applicants respectfully traverse Examiner's rejection.

Claim 1 recites an etching agent for etching copper at an approximately uniform rate throughout an etching process in an aqueous solution containing potassium hydrogen peroxomonosulfate. The etching agent has a concentration of potassium hydrogen peroxomonosulfate ranging between 10.01% to about 23.31% by weight of the etching agent.

One advantage of Claim 1 is the uniform etch rate that is provided by the etching agent. Since the etch rate is uniform, the rate may be controlled for preciseness when etching very fine line widths.

Mueller discloses a slurry used in a chemical-mechanical polishing ("CMP") process that includes an oxidizing agent, a catalyst and an abrasive material. Mueller describes the oxidizing agent as a monopersulfate. If the abrasive material is not included in the slurry, then an abrasive pad is used for polishing the wafer. See Mueller at col. 4 ll. 26-28. If the abrasive material includes a metal oxide, Mueller teaches that an additive such as acetic acid might be useful to stabilize the oxidizer in the presence of the metal complex present in the abrasive. See, Mueller at col. 7 ll. 43-47.

The catalyst is a necessary component for Mueller because it speeds the CMP process. CMP is a process that planarizes wafer surfaces that become uneven during processing so that additional layers may be deposited on the wafer in a planarized fashion. It is the action of the abrasive in combination with the oxidizer and the catalyst that controls the removal of material. See, Mueller at col. 4 ll. 26-30.

As stated above, Mueller teaches a slurry for CMP. This slurry is substantially different than the etching agent recited in Claim 1. The slurry arrangement of Mueller, as compared to the etching agent recited in Claim 1, works in a substantially different manner, and more importantly, gives a substantially different result. The etching agent

recited in Claim 1 specifically etches copper at a uniform rate, whereas the slurry of Mueller contains a catalyst to help flatten and smooth various layers (which may be of different materials) on the wafer during the CMP process. Since Mueller generally teaches the flattening and smoothing of multiple layers with the disclosed slurry, then explicitly, Mueller does not teach or disclose an etching agent for copper that etches at an approximately uniform rate throughout the etching process.

The etching agent of Claim 1, on the other hand, specifically etches copper at a uniform rate throughout the etching process. One advantage of such an etching agent is that it increases etch precision, thereby making it controllable and capable of forming a precise pattern throughout processing, a substantially different result than Mueller's slurry. In other words, Mueller does not anticipate or teach, explicitly or impliedly, that the disclosed slurry is an etching agent for copper. For at least these reasons, Claim 1 is patentable over Mueller.

Applicant respectfully submits that claims 2 and 17 are dependent on claim 1, and for the same reasons above, overcome the rejection under Mueller.

Rejection of Claims 1 and 2 under Condra *et al.* and Kubotera *et al.* under §103(a)

In the Office Action, Claims 1 and 2 stand rejected under 35 U.S.C. §103(a) as being anticipated by Condra *et al.* in view of Kubotera *et al.* Applicants respectfully traverse Examiner's rejection.

Examiner states that Condra, in conjunction with Kubotera, makes obvious the arrangement recited in Claim 1. Examiner states that Condra fails to teach the concentration of the peroxycompound to be used in the etching agent disclosed in Claim 1 of the instant application. See, Office Action at 4, ll.22 – 23, 5, ll.1-2.

In fact, Condra does not use peroxygen compounds as an etching agent. Instead, Condra uses the peroxygen compounds as a rejuvenator of the cleaning or etching material. The etching agents disclosed are: hydrochloric acid and ferric chloride; sulfuric acid in solution with cupric ions; and a combination of sulfuric acid and potassium dichromate. See Condra at col. 8 ll. 3-4, 22-23, 40-41. These "cleaning" agents consume tens of thousands of nanometers (or thousands of microinches) of copper per minute. Since Condra uses the peroxygen compounds as a rejuvenating

material, this reference teaches away from the use of potassium hydrogen peroxomonosulfate as an etching agent, making the arrangement recited in Claim 1 non-obvious. Therefore, Condra, alone or in combination, does not anticipate or suggest the arrangement of Claim 1.

Examiner also states that Kubotera et al. teaches an etching reagent that comprises an oxidizing agent used in a concentration of 0.01% to a maximum of about 10% by weight. Actually, the oxidizing agent required by Kubotera is a hydrogen peroxide or a peroxodisulfate compound. A peroxodisulfate compound contains twice the number of sulfate ions making it a much heavier molecule when combined with a cation. By weight, it would accomplish the task differently than the equivalent weight of potassium hydrogen peroxomonosulfate, an indication that the reaction paths for these two chemicals are different. The disulfates in Kubotera covalently bond to one another on an oxygen from each of the sulfate ions ( $\text{SO}_4^-$ ) whereas, potassium hydrogen monoperoxosulfate has an extra oxygen atom outside the single sulfate ion, ensuring that there is a different reaction path

Although the term “about” as decided in a higher court can be applicable, in this case, it is distinguishable. The peroxodisulfates are heavier and the chemical effect is somewhat different than potassium hydrogen monoperoxosulfate if the same weight of both materials is used. See Office Action at 5, I. 9. In this instance, “about” does not carry the preciseness that was before the court in the referenced case by Examiner. *In re Wertheim*, 541 F.2d 257, 267 (CCPA 1977). Therefore, it would be meaningless to apply “about 10% weight” to a chemical genus when a specific species is claimed and the chemical reaction path is different.

Further, there is no mention of the peroxomonosulfate oxidizers in Kubotera. Therefore, the use of potassium hydrogen monoperoxosulfate could not be obvious since that oxidizer genus was not taught, much less mentioned.

Examiner further states that Kubotera teaches an etching reagent that comprises an oxidizing agent and an organic acid such as the acetic acid in col. 13, ll. 22-39. In fact, Kubotera, teaches the oxidizing agent and organic acid are in combination with a third component, a compound that promotes the action of the oxidizing agent. See Kubotera, col. 13, ll. 26-33. For support, Kubotera lists examples of etching reagents

containing all three components in embodiments 2 and 6. Kubotera teaches that the action of the oxidizer needs to be promoted for enhancing the etching rate, making this compound critical to the arrangement, thus teaching away from the recited arrangement of Claim 2. Therefore, it is not at all obvious that the potassium hydrogen peroxomonosulfate would be a suitable etching agent in an aqueous solution without the promoting action of the metal compound.

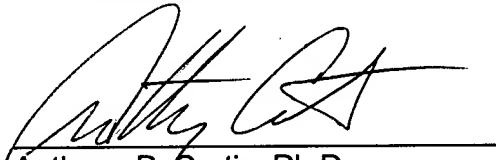
Since Kubotera and Condra are drawn to different subjects, Condra, for the aggressive cleaning of a copper surface in which the peroxygen compounds happen to be used as a rejuvenating material, and Kubotera, for the etching of copper printing plates in which peroxygen compounds of a different type are coupled with a compound for promoting the action of the oxidizer, there is no suggestion or motivation to combine these references. Nor is there any teaching that the combination provides a copper etching agent that provides the uniform etch recited in Claim 1.

Thus, neither Kubotera nor Condra, alone or in combination, anticipate or suggest the arrangement of amended Claim 1. Applicants submit that amended Claim 1 overcomes the §103(a) rejection. Also, applicants respectfully submit that Claims 2 and 17 are dependent on Claim 1, and therefore overcome the §103(a) rejection.

### **Conclusion**

In view of the amendments and arguments above, Applicants respectfully submit that all of the pending claims are in condition for allowance and seek an early allowance thereof. If for any reason the Examiner is unable to allow the application in the next Office Action and believes that a telephone interview would be helpful to resolve any remaining issues, he is respectfully requested to contact the undersigned.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Anthony P. Curtis', is written over a horizontal line.

Anthony P. Curtis, Ph.D.  
Registration No. 46,193  
Agent for Applicant

BRINKS HOFER GILSON & LIONE  
P.O. BOX 10395  
CHICAGO, ILLINOIS 60610  
(312) 321-4200